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EXAMINER

REPKO, JASON MICHAEL

ART UNIT PAPER NUMBER

2671

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/645,694

Applicant(s)

GREEN, ROBIN J.

Examiner

Jason M. Repko

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-40 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION***Drawings***

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 118 (Fig 2A), 142-1 (Fig 6), 156-2 (Fig. 7), 156-3 (Fig. 7). Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claims 2-7, 9-11, 15-21, 27, 31-35 and 37 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

4. Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine

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the claim term and set forth the uncommon definition so as to put one reasonably skilled in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999). The term “image” in claims 2, 4, 6, 9, 11, 10, 15, 16, 32, 37 is used by the claim to mean “modeled object”, while the accepted meaning is “a two-dimensional representation of the appearance of an object or scene from a given viewpoint.” For example, an image, by the accepted meaning, does not have a surface as described in claims 9, 15, 27 and 31.

5. Furthermore, paragraph 31 of the specification states “a high resolution object is used to work out where the shadow are defined and the nature of the intensity of the shadows...the use of a high resolution for the determination of the shadows allows for the data derived from the high polygon model to be stored and applied to a low polygon model in order to give a high resolution appearance to the low resolution image.” Claim 11 states “the image on the display screen is associated with a first resolution and the image is associated with a second resolution, wherein the first resolution is less than the second resolution,” which refers to the resolution on an image.” In the art, the meaning of the term resolution for a polygonal computer model of an object, which refers to the detail of the geometry, and the meaning of the term resolution for a computer image are contradictory. The office suggests using the language resolution of a polygonal model of an object to avoid confusion with the resolution of the image of a polygonal model of an object where necessary.

6. The term is indefinite because the specification does not clearly redefine the term. The remaining claims are rejected based on their dependence on the defective claims.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. **Claims 8, 9, 12-18, 20-21 and 26-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Sloan et al, "Precomputed radiance transfer for real-time rendering in dynamic, low-frequency lighting environments," July 23, 2002, ACM Transactions on Graphics, v. 21 n. 3 (herein referred to as "Sloan et al").**

9. With regard to claim 8, Sloan et al discloses "incorporating lighting characteristics of an image of an object into a texture map, comprising":

- a. "determining a lighting characteristic associated with a texel of the texture map" (*2nd paragraph of section 4.1: "Because N_p is known, the SH-projection of the transfer function (M^{DU}_p) can be precomputed, resulting in a transfer vector."*);
- b. "and associating the texel with the lighting characteristic" (*3rd paragraph of section 6: "The transfer vectors can also be stored in texture maps rather than per-vertex and evaluated using a pixel shader. "*);

10. Although Sloan et al teaches using the texture maps for storing transfer vectors, Sloan et al is silent on "defining a texture map associated with the image." However, this feature is deemed to be inherent to the rendering methods as the first paragraph of section 6 shows the transfer vectors are used in the rendering of object **O**, and the transfer vectors are stored in the texture maps. Therefore, the Sloan et al system would be inoperative if the texture maps were not associated with the object being rendered.

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11. With regard to claim 9, Sloan et al discloses a “method operation of determining a lighting characteristic associated with a texel of the texture map includes, identifying a point on the image” (3rd paragraph of section 5: “An initial pass simulates direct shadows from paths leaving L and reaching sample points $p \in O$ [model of an object].”); “and calculating a coefficient representing the lighting characteristic through the application of a basis function” (2nd paragraph of section 4: “In other words, each component of $(M_p)_i$ represents the linear influence that a lighting basis function $(L_p)_i$ has on shading at p .”; 1st paragraph of section 6: “...compute incident lighting $\{L_{Pi}\}$ at one or more sample points P_i near O in terms of the SH basis, 2. rotate L_{Pi} ...”).

12. With regard to claim 12, Sloan et al discloses “the lighting characteristic includes both self shadowing and self interreflection components” (Figure 2: “A transfer vector at a particular point on the surface represents how the surface responds to incident light at that point, including global transport effects like self-shadowing and self-interreflection.”).

13. With regard to claim 13, Sloan et al discloses “the method operation of determining a lighting characteristic associated with a texel of the texture map includes, calculating the lighting characteristic in a manner such that an intensity of the lighting characteristic does not fluctuate when a light source is moved” (1st paragraph of section 4.3: “An important limitation of precomputed transfer is that material properties of O influencing interreflections in T_{DI} and T_{GI} (like albedo or glossiness) must be ‘baked in’ to the preprocessed transfer and can’t be changed at run-time.”).

14. With regard to claim 14, Sloan et al discloses “the lighting characteristic is derived from a transfer function” (2nd paragraph of section 4.1: “Because N_p is known,

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the SH-projection of the transfer function (M^{DU}_p) can be precomputed, resulting in a transfer vector.")

15. With regard to claim 15, Sloan et al discloses "the transfer function calculates a value representing reflected light from a surface of the image" (*2nd paragraph of section 4.2: "We can then define the analogous three glossy transfer function for the unshadowed, shadowed, and interreflected cases as...which output scalar radiance in direction R as a function of L_p and R , quantities both unknown at precomputation time."*).

16. With regard to claim 16, Sloan et al discloses a method for rendering an image, comprising: "defining a texture map associated with the image" as shown in the rejection of claim 8; determining an intensity of a pixel associated with the texel, the determining including, accessing the value associated with the texel; and applying the value to a quantity representing a light source component (*2nd paragraph of section 6.2: "The resulting integral then becomes a simple dot product of the captured samples of $L_p(s)$ with the textures $B^m_l(s)$ "; Figure 2 shows an overview of this process*). Furthermore, Sloan et al teaches a method comprising the operation of "associating a value corresponding to a multi-directional signal with a texel of the texture map" (*1st paragraph of section 4.1: "... N_p is the objects normal at p , and $H_{N_p}(s) = \max(N_p \bullet s, 0)$ is the cosine-weighted, hemispherical kernel about N_p ."; 2nd paragraph of section 4.1: "Because N_p is known, the SH-projection of the transfer function (M^{DU}_p) can be precomputed, resulting in a transfer vector."; 3rd paragraph of section 6: "The transfer vectors can also be stored in texture maps rather than per-vertex and evaluated using a pixel shader."*) Sloan et al is silent on the textures comprising texels. However, this feature is deemed to be inherent to the texture map as lines 3rd paragraph of section 6

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shows that the textures are used to store transfer vectors. The Sloan et al storing operation would be inoperative if the texture was not made up of individual elements.

17. With regard to claim 17, Sloan et al discloses "the method operation of associating a value corresponding to a multi-directional signal with a texel of the texture map includes, computing a function representing reflected light over a sphere of incoming light relative to a point associated with the texel" (*5th paragraph of section 5: "In the first pass, for each $p \in O$ [model object], we cast shadow rays in the hemisphere about p 's normal N_p ...*").

18. With regard to claim 18, Sloan et al teaches "associating a value corresponding to a multi-directional signal with a texel of the texture map includes, inserting the value with data corresponding to the texel" (*3rd paragraph of section 6: "The transfer vectors can also be stored in texture maps rather than per-vertex and evaluated using a pixel shader."*).

19. With regard to claim 20, Sloan et al discloses "the method operation of applying the value to a quantity representing a light source component includes, projecting both the function representing reflected light and a function deriving the light source component into spherical harmonic coefficients" (*1st paragraph of section 4.1: "By SH-projecting L_p and H_{Np} separately, equation (5) reduces T_{DU} to an inner product of their coefficient vectors."*; *3rd paragraph of section 4.1: "Separately SH-projecting L_p and M_p again reduces the integral in T_{DS} to an inner product of coefficient vectors."*); "and defining an integral of a product of the function representing reflected light and the function deriving the light source component" (*see first two paragraphs of section 4.1 defining T_{DU} and T_{DS}*).

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20. With regard to claim 21, Sloan et al discloses “the integral is equal to a dot product of respective coefficients of each of the functions” (*1st paragraph of section 4.1*: “By SH-projecting L_p and H_{Np} separately, equation (5) reduces T_{DU} to an inner product of their coefficient vectors.”; *3rd paragraph of section 4.1*: “Separately SH-projecting L_p and M_p again reduces the integral in T_{DS} to an inner product of coefficient vectors.”). In the first two paragraphs of section 4.1, Sloan et al shows the equation for the T_{DU} and T_{DS} integrals.

21. With regard to the rejections of claims 26-31 that follow, Sloan et al does not use the explicit language “ computer readable medium with program instructions ”; however, one of ordinary skill in the art would recognize that this feature is inherent from the statement in the first paragraph of section 9: “For these models, multiplication with 25x25 or 9x25 transfer matrices over the surface in software forms the bottleneck.”

22. Claims 26-31 are rejected with the rationale of claims 8, 9, 12, 13, 14, and 15 respectively. Claims 26-31 recite claims 8, 9, 12, 13, 14, and 15 as a computer readable medium with program instructions.

Claim Rejections - 35 USC § 103

23. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

24. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

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1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

25. Claims 1-3, 10, 19, and 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sloan et al.

26. With regard to claim 1, Sloan et al teaches "a method for rendering an image with high resolution lighting characteristics, comprising: generating a texture map associated with the image, the texture map defined by texels." Although Sloan et al teaches using the textures for storing transfer vectors (*3rd paragraph of section 6: "The transfer vectors can also be stored in texture maps rather than per-vertex and evaluated using a pixel shader."*), Sloan et al is silent on the textures being defined by texels. However, this feature is deemed to be inherent to the texture map as lines third paragraph of section 6 shows that the textures are used to store transfer vectors. The Sloan et al system would be inoperative if the texture was not made up of individual elements. Furthermore, Sloan et al teaches a method for rendering comprising "calculating a value representing a lighting characteristic for each of the texels" (*2nd paragraph of section 4.1: "Because N_p is known, the SH-projection of the transfer function (M_p^{DU}) can be precomputed, resulting in a transfer vector."*); "storing the value" (*3rd paragraph of section 6: "The transfer vectors can also be stored in texture maps rather than per-vertex and evaluated using a pixel shader."*).

27. Sloan et al teaches rendering the image using the stored value, and discloses an algorithm in the first paragraph of section 6 ("We now have a model O capturing radiance transfer at many points p over its surface, represented as vectors or matrices.

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Rendering *O* requires the following steps at run-time...) Sloan et al is silent on associating a coordinate space of the texture map with a display screen coordinate space, and rendering on a display screen.

28. With regard to claim 10, Sloan shows the limitations of claim 8 on which claim 10 depends. Sloan et al teaches "the lighting characteristic defines shadows associated with the image being displayed" (*Figure 2 : "A transfer vector at a particular point on the surface represents how the surface responds to incident light at that point, including global transport effects like self-shadowing and self-interreflection."*). In figure 1, Sloan et al shows an image rendered using precomputed radiance transfer, which uses lighting characteristics as shown in the rejection of claim 8; however, Sloan et al is silent on rendering the image on a display screen.

29. With regard to claim 19, Sloan et al shows the limitations of claim 16 on which claim 19 depends. Sloan et al is silent on "displaying the pixel having the intensity."

30. Official Notice is taken that the concept and the advantage of "associating a coordinate space of the texture map with a display screen coordinate space, rendering the image on a display screen and displaying pixels" are well known and expected in the art. It would have been obvious to have included these operations in Sloan et al as "associating a coordinate space of the texture map with a display screen coordinate space, rendering the image on a display screen and displaying pixels" are known operations to provide visual feedback in computer graphics. Therefore, it would have been obvious to modify Sloan et al obtain the invention described in claims 1, 10 and 19.

31. With regard to claim 2, Sloan et al discloses "determining visibility from a point associated with one of the texels" (*3rd paragraph of section 5: "An initial pass simulates*

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direct shadows from paths leaving L and reaching sample points $p \in O$."); "and determining a distribution of an incoming light ray" (3rd paragraph of section 5: *"In subsequent passes, interreflections are added, representing paths from L that bounce a number of times off O before arriving at p (L_p , LD_p , LDD_p , etc.)"*). Sloan et al does not use the explicit language "associated with one of the texels"; however, one of ordinary skill in the art would recognize from the equations given in section 5, in the sixth and seventh paragraphs, that the results of the calculations are stored in the transfer vector $(M_p)_i$ and the transfer vector is stored in the texture map as shown in claim 1.

32. With regard to claim 3, Sloan et al discloses "an occlusion function is applied to determine the visibility" (2nd paragraph of section 4.1: *"...where the additional visibility function, $V_p(s) \rightarrow \{0,1\}$, equals 1 when a ray from p in the direction s fails to intersect O again (i.e., is unshadowed)."*; 5th paragraph of section 5: *"We tag each direction s_d with an occlusion bit, $1-V_p(s_d)$, indicating whether s_d is in the hemisphere and intersects O again (i.e., is self-shadowed by O)."*); "and ray tracing is applied to determine the distribution of incoming light" (7th paragraph of section 5: *"Later interreflection passes traverse the bins having the occlusion bit set during the shadow pass. Instead of shadow rays, they shoot rays that return transfer from exiting illumination on O."*).

33. Claim 22 is rejected with the rationale of claim 1. Claim 22 recites claim 1 as a computer readable medium with program instructions. As previously shown, Sloan et al teaches a computer readable medium.

34. With regard to claim 23, Sloan et al shows the limitations of claim 22 on which claim 23 depends. Sloan is silent on "mapping the coordinate space of the texture map with the display screen coordinate space." Official Notice is taken that the concept and

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the advantage of “mapping a coordinate space of the texture map with a display screen coordinate space, rendering the image on a display screen and displaying pixels” are well known and expected in the art. It would have been obvious to have included these operations in Sloan et al as “mapping a coordinate space of the texture map with a display screen coordinate space” are known operations to provide visual feedback in computer graphics. As previously shown, Sloan et al teaches a computer readable medium.

35. With regard to claim 24, Sloan et al shows the limitations of claim 22 on which claim 24 depends. Sloan et al teaches "the program instructions for applying the lighting characteristic value to a corresponding pixel for presentation on the display screen includes, program instructions for multiplying coefficients of the lighting characteristic with coefficients representing incoming light" (*1st paragraph of section 4.1: "By SH-projecting L_p and H_{Np} separately, equation (5) reduces T_{DU} to an inner product of their coefficient vectors."*; *3rd paragraph of section 4.1: "Separately SH-projecting L_p and M_p again reduces the integral in T_{DS} to an inner product of coefficient vectors."*). As previously shown, Sloan et al teaches a computer readable medium.

36. With regard to claim 25, Sloan et al teaches "the lighting characteristic is derived from a spherical harmonics based function" (*1st paragraph of section 3: "Spherical harmonics define an orthonormal basis over the sphere, $S...$ "; 2nd paragraph of section 3: "Because the SH basis is orthonormal, a scalar function f defined over S can be projected into its coefficients via the integral."*; *1st paragraph of section 4.1: "By SH-projecting L_p and H_{Np} separately, equation (5) reduces T_{DU} to an inner product of their coefficient vectors."*).

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37. **Claims 32 and 34-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sloan et al in view of U.S. Patent No. 6,639,595 to Drebin et al (herein referred to as Drebin et al.)**

38. With regard to claim 32, Sloan et al teaches a computing device (*1st paragraph of section 9: "Timings are on a 2.2 GHz Pentium 4 with ATI Radeon 8500 graphics card."*) comprising:

c. "a texel associated with data describing a light field for a point within the texel according to a basis function" (*2nd paragraph of section 4: "In other words, each component of $(M_p)_i$ represents the linear influence that a lighting basis function $(L_p)_i$ has on shading at p."*; *1st paragraph of section 6: "...compute incident lighting $\{L_{p_i}\}$ at one or more sample points P_i near O in terms of the SH basis..."*; *as previously shown $(M_p)_i$ is a transfer vector stored in a texture map containing texels*);

d. "logic for determining an intensity associated with the pixel based upon the data describing the light field" (*2nd paragraph of section 6.2: "The resulting integral then becomes a simple dot product of the captured samples of $L_P(s)$ with the textures $B^m_l(s)$ "*; *Figure 2 shows an overview of this process*).

39. Sloan et al does not use the explicit language "logic for accessing the data describing the light field" or "logic" as recited above; however, one of ordinary skill in the art would recognize that "logic" is the form of a software program that implements the method taught, which is shown by the statement in the first paragraph of section 9: "For these models, multiplication with 25x25 or 9x25 transfer matrices over the surface

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in software forms the bottleneck.” The transfer matrices are data describing the light fields, as shown in second paragraph of section 4 previously cited.

40. Sloan et al is silent on “a memory capable of storing data representing a texture map associated with an image, the texture map containing a texel, logic for mapping the texel to a pixel associated with a display screen in communication with the computing device, logic for enabling presentation of the intensity of the pixel on the display screen.”

41. Drebin et al discloses "a memory capable of storing data representing a texture map associated with an image, the texture map containing a texel " (*lines 29-33 of column 8: "Texture unit 500 (which may include an on-chip texture memory (TMEM) 502) performs various tasks related to texturing including for example: retrieving textures 504 from main memory 112..."*); “logic for mapping the texel to a pixel associated with a display screen in communication with the computing device” (*lines 14-17 of column 8: "Transform unit 300 transforms incoming geometry per vertex from object space to screen space; and transforms incoming texture coordinates and computes projective texture coordinates (300c)."*; *Fig 2 and Fig 5 show the texture unit is in communication with the computing device*); and "logic for enabling presentation of the intensity of the pixel on the display screen" (*lines 25-29 of column 8: "Setup/rasterizer 400 includes a setup unit which receives vertex data from transform unit 300 and sends triangle setup information to one or more rasterizer units (400b) performing edge rasterization, texture coordinate rasterization and color rasterization."*).

42. Claim 36 recites the limitations of claim 32 as an integrated circuit. Drebin et al discloses an integrated circuit (*lines 52-54 of column 6: "FIG. 3 is a block diagram of an example graphics and audio processor 114. Graphics and audio processor 114 in one*

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example may be a single-chip ASIC (application specific integrated circuit)."). In Fig. 4, Drebin et al shows the graphics and audio processor 114 comprises the 3D graphics pipeline, which comprises texture unit 500, transform unit 300, and Setup/rasterizer 400.

43. Sloan et al and Drebin et al are analogous art because they are from the same field of endeavor: real-time rendering. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the graphics system disclosed by Drebin et al to perform the method disclosed by Sloan et al. The motivation for doing so would have been to provide an interface for a user to interact with the three-dimensional graphics created by the Sloan et al system as stated by Drebin et al in lines 58-60 of column 4: "System 50 can be used to play interactive 3D video games with interesting stereo sound." Therefore, it would have been obvious to combine Sloan et al with Drebin et al to obtain the invention specified in claims 32 and 36.

44. Claim 34 is met by the combination of Sloan et al and Drebin et al, wherein Drebin et al discloses "a display screen in communication with the computing device" (5-8 lines of column 5: "*To play a video game or other application using system 50, the user first connects a main unit 54 to his or her color television set 56 or other display device by connecting a cable 58 between the two.*"; 9-10 lines of column 5: "*The video signals are what controls the images displayed on the television screen 59...*").

45. Claim 35 is met by the combination of Sloan et al and Drebin et al, wherein Sloan et al discloses the logic for determining an intensity associated with the pixel based upon the data describing the light field includes, logic for determining an incoming illumination value" (*1st paragraph of section 6: "...compute incident lighting $\{L_{Pi}\}$ at one or more sample points P_i near O in terms of the SH basis...*"); "and logic for

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combining the incoming illumination value with the data describing the light field" (2nd paragraph of section 4: "In other words, each component of $(M_p)_i$ represents the linear influence that a lighting basis function $(L_p)_i$ has on shading at p ."; equations for computing $(M_p)_i$ are given in 6th and 7th paragraphs of section 5).

46. Claims 37 and 38 are met by the combination of Sloan et al and Drebin et al, wherein Drebin et al discloses "the image is associated with a video game" and "the integrated circuit is incorporated into a video game console" (lines 54-57 of column 4: "FIG. 1 shows an example interactive 3D computer graphics system 50. System 50 can be used to play interactive 3D video games with interesting stereo sound."; Fig. 2 shows the graphics processor 114 incorporated into system 50).

47. Claim 39 is met by the combination of Sloan et al and Drebin et al, wherein Drebin et al discloses "the data is associated with a texel of a texture map stored in memory" (lines 29-33 of column 8: "Texture unit 500 (which may include an on-chip texture memory (TMEM) 502) performs various tasks related to texturing including for example: retrieving textures 504 from main memory 112...").

48. Claim 40 is met by the combination of Sloan et al and Drebin et al, wherein Drebin et al discloses "wherein a lookup table maps the texel to the pixel" (lines 16-20 of column 10: "While texture function 306 may be implemented in a variety of different ways, a cost-effective approach is to store the texture function 306 output values in a texture lookup table or map and to access those values using texture coordinates.").

49. **Claims 4-7 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sloan et al in view of Cignoni et al, "A general method for preserving attribute**

values on simplified meshes," October 1998, Proceedings of the conference on Visualization 1998, p. 59-66 (herein referred to as "Cignoni et al.")

50. With regard to claim 4, Sloan et al discloses the method operation of calculating a value representing a lighting characteristic for each of the texels includes, "and applying a basis function to determine the value" (*2nd paragraph of section 4: "In other words, each component of $(M_p)_i$ represents the linear influence that a lighting basis function $(L_p)_i$ has on shading at p ."*; *1st paragraph of section 6: "...compute incident lighting $\{L_{Pi}\}$ at one or more sample points P_i near O in terms of the SH basis..."*). Sloan et al does not explicitly disclose "defining an image associated with a first resolution" as in claim 4, and "the image on the display screen is associated with a second resolution, the second resolution being less than the first resolution" as in claim 6 or 11.

51. With regard to claims 4, 6 and 11, Cignoni et al teaches "defining an image associated with a first resolution," as in claim 4, and "the image on the display screen is associated with a second resolution, the second resolution being less than the first resolution" as in claims 6 and 11 (*5th paragraph of section 1: "It is performed by assuming that the simplified mesh S has a sufficiently similar shape if compared with the original high resolution mesh M ...The retrieved attribute values are then stored in a texture map [10], which we later use to paint the pictorial detail of mesh M onto mesh S "*).

52. Cignoni et al does not use the explicit language "display screen"; however, one of ordinary skill in the art would recognize that this feature is inherent from the statement in the third paragraph of section 5 "...converted into a 2D texture, and finally rendered with

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a standard OpenGL viewer. The Cignoni et al system would be inoperable if a display screen were not present.

53. Sloan et al and Cignoni et al are analogous art because they are from the same field of endeavor: computer image rendering. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate the method to simplify the mesh while preserving detail as taught by Cignoni et al in the method taught by Sloan et al. The motivation for doing so would have been to allow one to de-couple simplification from detail preservation as stated by Cignoni et al in the third paragraph of section 6, which would allow for a more efficient representation of the model. Therefore, it would have been obvious to combine Sloan et al with Cignoni et al to obtain the invention specified in claims 4, 6 and 11.

54. Claim 5 is met by the combination of Sloan et al and Cignoni et al, wherein Sloan et al teaches "the value is represented by multiple coefficients" (*1st paragraph of section 4: "Incident lighting is therefore represented as a vector of n^2 coefficients $(L_p)_i$."*).

55. Claim 7 is met by the combination of Sloan et al and Cignoni et al, wherein Sloan et al teaches "the method operation of applying a basis function to determine the value includes, executing a transfer function to yield the value" (*2nd paragraph of section 4.1: "We call the resulting factors the light function L_p , and the transfer function, M_p ."; 1st paragraph of section 6: "...3. perform a linear transformation in $(L_p)_i$ at each point p on O to obtain exit radiance. This requires a dot product with $(M_p)_i$ for diffuse surfaces..."*).

56. **Claims 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sloan et al in view of Drebin et al and in further view of U.S. Patent 6,672,964 to Kobayashi (herein referred to as "Kobayashi et al.")**

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57. With regard to claim 33, the combination of Sloan et al and Drebin et al shows a video game console, wherein Drebin et al discloses "the computing device is one of a video game console and a server" (*lines 58-60 of column 4: "System 50 can be used to play interactive 3D video games with interesting stereo sound."*), as well as the limitations of the parent claim 32. The combination of Sloan et al and Drebin et al does not disclose a server. Kobayashi discloses a server (*lines 55-58 of column 7: "The communications interface 19 is connected to a network 110, and acquires various kinds of data by performing data communications with data storage devices and information processing devices such as servers installed in other locations."; Figure 1*).

58. Sloan et al, Drebin et al and Kobayashi et al are analogous art because they are from the same field of endeavor/similar problem solving area: real-time rendering. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate a server as disclosed by Kobayashi et al into the Sloan et al and Drebin et al combination. The motivation for doing so would have been allow the data to be stored at a remote location as described by Kobayashi et al in lines 55-58 of column 7, which would be advantageous for multi-player video games as described by Kobayashi et al in various aspects of the invention (*for example, lines 15-18 of column 2: "first aspect of the invention provides a computer-readable recording medium on which is recorded a video game program capable of displaying multiple characters including a player character..."*), because the players do not have to be at a specific physical location to participate in the same game. Therefore, it would have been obvious to combine Sloan et al and Drebin with Kobayashi et al to obtain the invention specified in claim 33.

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Conclusion

59. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Jonathan Cohen, Marc Olano, Dinesh Manocha, "Appearance-Preserving Simplification," 1998, Proceedings of the 25th annual conference on Computer graphics and interactive techniques, p. 115-122 teaches texture mapping simplified meshes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The examiner can normally be reached Monday through Friday 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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